Performance and Haematological Indices of Broiler Chickens Fed Diet Containing Graded Level of Moist Heat Treated *Gmelina arborea* Seed Meal

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Abstract. Experiment evaluating the effect of moist heat treated *Gmelina arborea* seed meal (MHGASM) on the growth performance and hematological indices in broiler chickens was conducted using one hundred and twenty (120) two weeks old broiler chickens which were randomly allotted to four dietary treatments consisting three replicates each with each replicate containing ten birds in a complete randomized design. The feed having 0% of MHGASM was taken as the reference diet, and the three diets to which MHGASM were included at graded level of 20, 25 and 30% as T2, T3 and T4 respectively were used for the comparison with the reference diet. Birds were fed the experimental diets and water supplied adlibitum during the feeding trial that lasted for 56 days. The results showed that final body weight, weight gain and feed conversion ratio were significantly affected by the dietary treatments while feed intake was not significantly influenced by the diets. Birds fed T4 (30% MHGASM inclusion level) diet had the highest final body weight, weight gain and best feed conversion ratio. Similarly, significant differences were recorded on all the hematological parameters investigated except hemoglobin concentration of the broilers across the treatment diets. Birds fed T4 diet recorded a higher mean values in all the hematological parameters except in WBC where T3 had the highest mean value. From the result of the study, it was therefore concluded that birds fed T4 (30% MHGASM)diet had an improved performance and the inclusion of moist heat treated *Gmelina arborea* seed in the diet of broilers do not have any negative effect on their physiological and immune system. Thus, moist heat treated *Gmelina arborea* seed meal may serve as a useful alternative for protein and fiber in compounding feed for broiler chickens.

Key words: Performance**,** hematology, moist heat treated, *Gmelina arborea*, broiler chickens

Abstrak. Percobaan mengevaluasi pengaruh tepung *Gmelina arborea* (jati) yang diuapkan (MHGASM) pada kinerja pertumbuhan dan indeks hematologis ayam broiler dilakukan menggunakan 120 ekor ayam broiler berumur 2 minggu yang secara acak dibagi ke dalam empat perlakuan pakan. Perlakuan diulang tiga kali, setiap ulangan terdiri atas 10 ayam, dan menggunakan Rancangan Acak Lengkap. Pakan dengan 0% MHGASM dijadikan pakan kontrol, dan tiga pakan mengandung MHGASM sebanyak 20, 25 dan 30% sebagai T2, T3 dan T4 digunakan sebagai pembanding pakan kontrol. Ayam mengkonsumsi pakan percobaan dan air diberikan ad libitum selama 56 hari percobaan. Hasil menunjukkan bahwa bobot akhir, penambahan bobot dan tingkat konversi pakan dipengaruhi oleh perlakuan pakan, sedangkan asupan pakan tidak dipengaruhi oleh pakan. Ayam yang diberi pakan T4 (30% MHGASM) memiliki bobot akhir dan penambahan bobot tertinggi, serta tingkat konversi pakan terbaik. Perbedaan nyata juga terdapat pada semua parameter hematologis kecuali konsentrasi hemoglobin pada broiler disetiap perlakuan pakan. Ayam yang diberi pakan T4 (30% MHGASM) memiliki nilai rataan tertinggi di semua parameter hematologi kecuali sel darah putih yang rataan tertingginya pada pakan T3 (25% MHGASM). Dari hasil penelitian disimpulkan bahwa ayam yang diberi pakan T4 menunjukkan peningkatan kinerja dan penambahan tepung jati yang diuapkan pada pakan broiler tidak menimbulkan dampak negatif terhadap fisiologi dan sistem kekebalan tubuh. Dengan demikian, tepung jati yang diuapkan dapat digunakan sebagai pengganti protein dan serat dalam pakan ayam broiler.

Kata kunci: Kinerja, hematologi, penguapan, *Gmelina arborea*, ayam broiler

Introducton

The problem of food deficiency in underdeveloped and developing countries has continued to worsen due to the perpetual increase in human population. The total effect of the problem is the great demand created for food, particularly foods of animal origin and products (Smith, 1998). In order to meet the demand, the production of food must be increased especially those of the basic nutrients, energy and protein. However, production of livestock to alleviate the food protein shortage depends largely on availability of good quality and cheap feeds for animals especially those on intensive system of production whose performance rest largely on standard conventional feeding (Annongu et al., 2004). Conversely, livestock farmers, especially those in Nigeria and neighboring countries are faced with the problem of continuous inadequacy of feed ingredients. This arises from the ever-increasing needs of men for the same livestock feed ingredients for his food and industrial raw materials used in the production of other materials like maize, millet, sorghum, soybean, groundnut, cassava and other tubers. Along with man and industrial demands is the rising cost of existing material (Durunna et al., 2006). Expenses incurred on feeds constitute 70-80% of livestock farm recurrent expenditure (Olomu, 2003). The resultant effect of high demand and rising cost is scarcity, thus farmers are unable to meet the feed requirements of their livestock and consequently they are forced to close their farms or run at very low level of stock (Durunna et al., 2006). Intensive poultry production has been identified as one of the means of attaining sufficiency in the supply of animal protein to the diet of average Nigerians. However, intensive poultry management has brought ways of improving growth performance of table birds especially broilers to attain a minimum market weight of 2 kg after 8 weeks. Broilers provide the much needed animal protein in the diet of an average Nigerian and currently animal protein intake is below the recommended daily allowance, so it is necessary to introduce an alternative, cheap and available materials feed to substitute the existing broiler feed.

Developing and underdeveloped countries including Nigeria are facing serious increase in competition between mankind and animal for the available conventional foods stuffs especially the monogastric animals (Queresh, 1980). This increase in competition and scarcity of food have drawn the attention of Nutritionists, Scientists, and Agriculturist to the need for research into the use of unconventional feed stuffs that are not staple for man, to meet the nutritional needs of the livestock. *Gmelina arborea* is one of such novel feed stuffs and little work has been done on the utilization of *Gmelina arborea* in the nutrition of monogastrics (Annongu and Folorunso, 2003). *Gmelina arborea* has been planted extensively in Syria Leone, Nigeria, and Malaysia. The timber has general utility such as ornamental works, matches and paper making. In Nigeria, the tree grows in farms, nurseries and near homesteads, especially in the south, but has not been fully exploited as food resources. The reason might due to insufficient research works on the nutritional composition of the component parts of the plant. The available data of the composition of the tree of this genus are scarce (Akinjagunla et al., 2007). Hematological analysis, for instance, is significant in nutritional studies because blood, the metabolites and their concentrations provides information for indirect nutritional assessment due to the fact that food or feed components affect body constituents (Harper et al., 1979). Therefore, this study was carried out to determine the effect of feeding graded levels of moist heat treated *Gmelina arborea* seed meal on growth performance and

hematological characteristics of broiler chickens.

Materials and Methods

Experimental location. This study was conducted at the Teaching and Research Farm of the Federal College of Wildlife Management, New Bussa, Niger State, Nigeria.

Processing the test ingredient. The fresh ripened fruits were pounded in a mortal with pistol to separate the seed from the fruit; this is in line with Annongu et al. (2004). The separated seeds were washed and were subjected to moist heat treatment, which is done by exposing the seeds to continuous flow of steam from water boiling at a temperature of 100^0 C for one hour in a fume cupboard in order to remove the anti-nutritional factors (especially phytate) present. After the moist heat treatment of the seeds they were air-dried and milled into smaller particles before being added to the experimental diets at different graded levels.

Experimental birds, design and diet formulation. One hundred and twenty (120) day-old broiler chicks were used for the experiment. All the birds were brooded and placed on commercial broiler starter diet containing 23% crude protein at the first two weeks. After the brooding stage, the birds were randomly distributed into four treatment groups, each treatment group had 30 birds and a treatment was replicated three times with 10 birds per replicate using Complete Randomized Design (CRD). Four experimental treatment diets ration were formulated with T1 being the control diet contained no MHGASM while T2, T3, and T4 contained 20, 25 and 30% graded level MHGASM of respectively as shown in Table 1 at starter and finisher phase.

Results and Discussion

The growth performance of the broiler chickens fed graded levels of MHGASM is shown in Table 2. The results revealed that final body weight, weight gain, feed intake and FCR showed no significant effect (P<0.05) between the treatments. Birds fed 30% MHGSAM diet had the highest final body weight, weight gain and feed intake compared to birds fed the

Table 1. Composition of the experimental diets

Ingredients	Starter diet				Finisher diet			
	T1	T2	T3	T4	T1	T2	T3	T4
Maize	50.00	50.00	50.00	50.00	53.00	53.00	53.00	53.00
Soybean	31.55	16.36	12.55	8.77	24.50	9.31	5.50	1.72
Fishmeal	4.00	4.00	4.00	4.00	2.00	2.00	2.00	2.00
PKC	10.00	5.19	4.00	2.78	15.50	10.69	9.50	8.28
Palm oil	0.60	0.60	0.60	0.60	1.15	1.15	1.15	1.15
Bonemeal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
GASM	-----	20.00	25.00	30.00	-----	20.00	25.00	30.00
Total	100	100	100	100	100	100	100	100
Calculated analysis								
Energy (MJ/Kg)	11.92	11.33	12.27	12.97	10.33	10.68	10.93	11.03
Crude Protein (%)	21.96	21.4	22.8	23.00	20.93	20.22	20.94	21.09
Crude Fiber %	4.20	5.23	5.10	4.00	5.98	6.23	6.89	5.68

The feed having 0% of MHGASM was taken as the reference diet (T1), and the three diets to which MHGASM were included at graded level of 20, 25 and 30% as T2, T3 and T4

control diet, while birds fed 10% MHGASM diet had the least performance. The lowest FCR value was obtained on the birds fed 30% MHGASM diet; while birds fed 10% MHGASM had the highest FCR value. However, birds on 30% MHGASM diet recorded significantly (P<0.05) higher body weight gain. This might have resulted from the high crude protein and ME level in their diet. It has been documented that increased crude protein level results in increased growth and feed efficiency (Pesti, 2009 and Berres et al, 2010). Besides, the enhanced performance of the broiler chickens fed 30% MHGASM diet with reference to those on the control diets might be as a result of the ability of the birds to efficiently digest, absorb and utilized components of their feed more efficiently via the moist heat detoxification treatment on the effect of anti-nutritional factors in the diet (Huisman, 1995). Results obtained in this study showed that MHGASM inclusion in broiler diet significantly (P<0.0) affected packed cell volume (PCV), red blood cell (RBC) and white blood cell (WBC) concentration, while hemoglobin (Hb) concentration was not significantly (P>0.05) affected across the treatments. There was no consistent trend observed in all the hematological parameters investigated. However, birds fed 30% MHGASM had a higher PCV, Hb and RBC concentrations compared to the birds fed 0, 20 and 25% MHGASM. Birds fed 25% MHGASM had significantly higher WBC compared to birds fed the control diet. The favorable hematological profile of birds on 30% MHGASM compared to birds fed other dietary treatments could be due to the relatively low level of crude fiber. The high values of PCV, Hb and RBC which were relatively best at 30% dietary level showed enhanced quality of blood. Higher PCV values have been correlated with the nutritional status of the animals (Iheukwumere, 2008). The decrease in PCV, Hb and RBC of birds on diets T2 and T3 could be due to increased crude fiber. This was in agreement with Ross and Enridwez (1978) that

Table 2. Effects of moist heat treated *Gmelina arborea* seed meal on the growth performance of broiler chicken

Parameter	T1	T2	T3	T4
Av. Initial Wt (g/b)	98.3	96.3	98.6	98.6
Av. Final Wt (g/b)	2.15^{bC}	2.10^{C}	2.23^{b}	2.58^{a}
Av. Wt gain (g/b/d)	82.09	81.39	83.11	84.55
Av. Feed intake (g/b/d)	36.69^{b}	35.73^{b}	38.11^{b}	44.36^{a}
FCR	2.24	2.27	2.18	1.91

^{abc} Values bearing different superscript within rows show significant difference (P<0.05)

The feed having 0% of MHGASM was taken as the reference diet (T1), and the three diets to which MHGASM were included at graded level of 20%, 25% and 30% as T2, T3 and T4

Table 3. Effects of treated *Gmelina arborea* seed meal on the hematological indices of broiler chickens

Parameters	T1	T2	T3	T4	SEM
PCV (%)	25.67^{ab}	24.33^{b}	27.33^{a}	28.33^{a}	0.847
Hb (g/dl)	8.13^{a}	7.77^{a}	7.43^{a}	8.97^{a}	0.260
RBCx10^{12}/l	2.24^{b}	2.16^{b}	1.85^{c}	2.55^{a}	0.10
WBCx10^{9}/l	24.53^{bc}	22.60^{c}	30.83^{a}	25.63^{b}	0.60

^{abc} Values bearing different superscript within rows show significant difference (P<0.05)

The feed having 0% of MHGASM was taken as the reference diet (T1), and the three diets to which MHGASM were included at graded level of 20%, 25% and 30% as T2, T3 and T4

high fiber in monogastrics diets could be likened to feed restriction which lowered hematological profile. Furthermore, the numerical reductions in Hb and RBC contents of the blood of broilers fed diet T2 and T3 were an indication that the oxygen carrying capacity of the animals' blood would be reduced. The numerical increase in white blood cell (WBC) counts of birds on 25 and 30% MHGASM based diets implied that the ingestion of MHGASM might have increased the production of these blood components against residual metabolites in the treated seed meal. Besides, the lower WBC obtained in birds fed the control diet than those obtained in birds fed MHGASM based diets could be explained by an increased need to challenge the foreign body in form of anti-nutritional factors in the diets formulated with graded levels of MHGASM. The increased concentrations of anti-nutritional factors with increasing MHGASM would have elicited responses of increased WBC (antibodies) for defense. However, the hematological values observed in this study fell within the range recommended by Mitruka and Rawnsley (1977) for normal healthy chicken.

Conclusion and Recommendation

Conclusively, the performance and hematological profile of birds in this present study suggested that up to 30% MHGASM could be successfully included in broiler diets without any adverse effect.

Based on the result obtained from this experimental trial, it is therefore recommended that moist heat treated *Gmelina arborea* seeds should be included in animal feed, especially at 30% inclusion level. More work should be done on higher inclusion level of 40% and 50% and further investigation may be necessary to ascertain the performance of pullets when fed treated *Gmelina arborea* seeds meal at various inclusion levels.

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